

CLAIMS:

1. A method for the deposition of a thin film of a pre-determined composition onto a substrate, said composition comprising a ternary, quaternary or higher composition, comprising the steps of:
 - (i) placing a pellet of at least one sulphide on a first source and placing a pellet of at least one sulphide on a second source, the sulphides on the first and second sources being different, said sulphides being the components of said composition, at least one of the pellets on the first and second sources additionally containing dopant for the composition;
 - (ii) effecting vapour deposition of said composition on said substrate by simultaneously vaporizing the pellets on the first and second sources with separate electron beams; and
 - (iii) monitoring the rate of vaporizing of sulphide from the first source with a first coating rate monitor and monitoring the rate of vaporizing of sulphide from the second source with a second coating rate monitor, said first coating rate monitor being shielded from deposition of sulphide from the second source and said second coating rate monitor being shielded from deposition of sulphide from the first source.
2. The method of Claim 1 in which, in step (ii), the temperature of said first and second sources is controlled.
3. The method of Claim 2 in which, in step (iii), the temperature of each of the first and second coating rate monitors is monitored and controlled.
4. The method of Claim 1 in which the composition is a thin film phosphor.
5. The method of Claim 3 in which said composition is selected from the group consisting of ternary, quaternary and higher compositions of at least one cation from Groups IIA and IIB of the Periodic Table.
6. The method of Claim 1 in which said composition is selected from the group consisting of thioaluminates, thiogallates and thioindates of at least one

cation from Groups IIA and IIB of the Periodic Table.

7. The method of Claim 3 in which, in step (i), sulphide is located at a third source, said third source having a coating rate monitor that is screened from the first and second sources, said rate of coating from the third source being monitored and controlled.
8. The method of Claim 3 in which, in step (i), the dopant is located at a third source, said third source having a coating rate monitor screened from the first and second sources, said rate of coating from the third source being monitored and controlled.
9. The method of Claim 6 in which said substrate is opaque in the visible and infrared regions of the electromagnetic spectrum.
10. The method of Claim 6 in which the composition is a ternary composition.
11. The method of Claim 6 in which the composition is a quaternary composition.
12. The method of Claim 3 in which, in step (iii), vapour deposition is carried out in an atmosphere of H_2S .
13. The method of Claim 6 in which said composition is of the formula $Ba_aCa_{1-a}Al_2S_4:Eu$, where "a" is the range of 0 to 1.
14. The method of Claim 13 in which the composition is $CaAl_2S_4:Eu$.
15. The method of Claim 6 in which the cation is selected from the group consisting of barium, calcium, strontium, magnesium, zinc and cadmium, and mixtures thereof.
16. The method of Claim 3 in which the substrate temperature is

monitored.

17. The method of Claim 4 in which the composition deposited on the substrate is a single crystal phase.

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18. The method of Claim 4 in which the composition deposited on the substrate is more than one crystal phase.

19. A composition deposited on a substrate, said composition comprising a thioaluminate, thiogallate or thioindate of at least one cation selected from Groups IIA and IIB of the Periodic Table, said composition having been formed by the method of Claim 1.

20. The composition of Claim 19 in which the composition is of the formula $Ba_aCa_{1-a}Al_2S_4:Eu$, where "a" is the range of 0 to 1.

21. The composition of Claim 20 in which the composition is $CaAl_2S_4:Eu$.

22. The composition of Claim 19 in which the composition is an alkaline earth thioaluminate.

23. The composition of Claim 19 in which the cation is selected from the group consisting of barium, calcium, strontium, magnesium, zinc and cadmium, and mixtures thereof.

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24. A method for the deposition of a thin film of a pre-determined composition onto a substrate, said composition comprising a ternary, quaternary or higher composition, comprising the steps of:

- (i) placing a first deposit at a first source of a vapour deposition apparatus and placing a second deposit at a second source of the vapour deposition apparatus, said first and second deposits being different, components of said first and second deposits in combination forming said pre-determined composition;
- (ii) determining temporal variation of deposition of said components onto

said substrate from said first and second sources; and

(iii) using said temporal variation for controlling said first and second sources so as to obtain homogeneous temporal deposition of said composition on the substrate by simultaneous vapour deposition from said sources.

25. The method of Claim 24 in which said temporal variation is obtained by monitoring the rate of vaporizing from the first source with a first coating rate monitor and monitoring the rate of vaporizing from the second source with a second coating rate monitor, said first coating rate monitor being shielded from deposition from the second source and said second coating rate monitor being shielded from deposition from the first source.

26. The method of Claim 25 in which said monitoring is used as the determining of temporal deposition of step (ii).

27. The method of Claim 26 in which said monitoring of step (ii) is used in step (iii).

28. The method of Claim 24 in which said composition is a thin film phosphor.

29. The method of Claim 28 in which said composition is selected from the group consisting of thioaluminates, thiogallates and thioindates of at least one cation from Groups IIA and IIB of the Periodic Table.

30. The method of Claim 24 in which the composition is a dielectric thin film.

31. The method of Claim 30 in which there is the additional step of depositing a phosphor juxtaposed to said dielectric thin film.

32. The method of Claim 24 in which the first and second deposits are sulphides.

33. The method of Claim 24 in which a third deposit is placed at a third source, components of said third deposit forming part of said composition.
- 5 34. The method of Claim 24 in which said substrate is opaque in the visible and infrared regions of the electromagnetic spectrum.
35. The method of Claim 24 in which said composition is of the formula $\text{Ba}_a\text{Ca}_{1-a}\text{Al}_2\text{S}_4:\text{Eu}$, where "a" is the range of 0 to 1.
- 10 36. The method of Claim 24 in which the cation is selected from the group consisting of barium, calcium, strontium, magnesium, zinc and cadmium, and mixtures thereof.
- 15 37. The method of Claim 24 in which vapour deposition is by sputtering.
38. The method of Claim 37 in which the composition is a thin film.
39. The method of Claim 24 in which vapour deposition is by electron
20 beam.
40. The method of Claim 39 in which temperature of said first and second sources is controlled.
- 25 41. The method of Claim 24 in which vapour deposition is by thermal evaporation.
42. The method of Claim 41 in which temperature of said first and second sources is controlled.
- 30 43. The method of Claim 39 in which said composition is of the formula $\text{Ba}_a\text{Ca}_{1-a}\text{Al}_2\text{S}_4:\text{Eu}$, where "a" is the range of 0 to 1.
44. The method of Claim 39 in which the composition is $\text{CaAl}_2\text{S}_4:\text{Eu}$.